UL 1691

STANDARD FOR SAFETY

Single Pole Locking-Type Separable Connectors

UL Standard for Safety for Single Pole Locking-Type Separable Connectors, UL 1691

First Edition, Dated February 29, 2012

Summary of Topics

This revision to ANSI/UL 1691 is being issued to incorporate the following new requirements:

Short Time Current testing of Single Pole Separable Connectors

New Supplement SA – REPLACEMENT ENCLOSURE FOR USE WITH SPECIFIC MANUFACTURER'S SINGLE POLE LOCKING – TYPE SEPARABLE ATTACHMENT PLUG and CABLE CONNECTOR

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and/or revised requirements are substantially in accordance with Proposal(s) on this subject dated May 25, 2018.

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Single Pole Locking-Type Separable Connectors

February 29, 2012

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ANSI/UL 1691-2018

Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as "CSA Group") and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at any time. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquires@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the First Edition including revisions through July 27, 2018. The most recent designation of ANSI/UL 1691 as an American National Standard (ANSI) occurred on July 27, 2018. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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CONTENTS

SUPPLEMENT SA - REPLACEMENT ENCLOSURE FOR USE WITH SPECIFIC MANUFACTURER'S SINGLE POLE LOCKING-TYPE SEPARABLE ATTACHMENT PLUG and CABLE CONNECTOR

INTRODUCTION

CONSTRUCTION

PERFORMANCE

MARKINGS

INSTRUCTIONS

Preface

This is the harmonized CSA Group and UL Standard for Single Pole Locking-Type Separable Connectors. It is the First edition of CSA C22.2 No. 1691 and the First edition of UL 1691. This harmonized standard has been jointly revised on July 27, 2018. For this purpose, CSA Group and UL are issuing revision pages dated July 27, 2018.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Single-Conductor Pin and Sleeve Connectors Committee of the Council on the Harmonization of Electrotechnical Standards of the Nations of the Americas (CANENA) are gratefully acknowledged.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This standard was reviewed by the CSA Integrated Committee on Wiring Devices, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee.

Where reference is made to a specific number of specimens to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of harmonization

This standard uses the IEC format but is not based on, nor is considered equivalent to, an IEC standard.

This standard is published as an equivalent standard for CSA Group and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Reasons for differences from IEC

This standard provides requirements for single pole locking-type separable connectors for use in accordance with the electrical installation codes of Canada and the United States. At present there is no IEC standard for these products for use in accordance with these codes. Therefore, this standard does not employ any IEC standard for base requirements.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

SINGLE POLE LOCKING-TYPE SEPARABLE CONNECTORS

1 Scope

1.1 These requirements cover single pole locking-type separable attachment plugs, cord connectors, panel inlets, and panel outlets, adapters, and accessories, rated up to a maximum of 800 amperes and up to 600 volts ac or dc and not intended for connection or disconnection under load conditions.

1.2 These devices are intended to provide power from feeders or branch circuits, or are for direct connection to feeders or branch circuits in accordance with the Canadian Electrical Code (CEC), Part I, C22.1, and the National Electrical Code (NEC), ANSI/NFPA-70 for the following applications:

CEC

Amusement parks, midways, carnivals, film and TV sets, TV remote broadcasting locations, traveling shows (Section 66) and similar venues and installations where such temporary connections could be used.

NEC

a) Places of assembly (assembly occupancies) (Article 518)

b) Theaters, audience areas of motion picture and television studios, performance areas, and similar locations (Article 520)

c) Carnivals, circuses, fairs and similar events (Article 525)

d) Motion pictures and television studios and similar locations (Article 530)

e) Motion picture projection rooms (Article 540)

f) Temporary installations such as construction sites (Article 590)

1.3 These devices are not intended for use in hazardous locations.

1.4 Attachment plugs and cord connectors are intended for use with cables, as defined in applicable electrical codes, having copper conductors only, for use in either outdoor or indoor locations.

1.5 Inlets and outlets are intended for use with cables or bus bars, as defined in applicable electrical codes, having copper conductors only, for use in either outdoor or indoor locations.

1.6 This Standard does not apply to:

a) Plugs, Receptacles, and Cable Connectors, of the Pin and Sleeve Type covered by UL 1682 and CSA C22.2 No. 182.1.

b) Devices molded integrally with flexible cord or cable that are covered by the Standard for Cord Sets and Power-Supply Cords, UL 817, and Cord Sets and Power Supply Cords, CSA C22.2 No. 21.

c) General and special use devices, such as attachment plugs, receptacles, cord connectors, inlets, current taps, flatiron and appliance plugs, that are covered by the Standard for Attachment Plugs and Receptacles, UL 498, and General Use Receptacles, Attachment Plugs, and Similar Wiring Devices, CSA C22.2 No. 42, Appliance Plugs for Heater Cord Sets, CSA C22.2 No. 57, and Industrial Locking Types, Special Use Attachment Plugs, Receptacles and Connectors, CSA C22.2 No. 182.2.

d) Single and multi-pole connectors, which may include 3 or more pilot contacts, intended for connection to copper conductors, for use in data, signal, control and power applications within and between electrical equipment, where exposed, that are covered by the Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977, and Special Use Attachment Plugs, Receptacles and Connectors, CSA C22.2 No. 182.3.

e) Devices intended for use in hazardous (Classified) locations that are covered by the Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations, UL 1010, and Attachment Plugs, Receptacles and Similar Wiring Devices for Use in Hazardous Locations: Class I, A, B, C, and D, Class II, Group G in Coal or Coke Dust, and in Gaseous Mines, CSA C22.2 No. 159.

f) Products such as switched interlocks that are covered by the Standard for Industrial Control Equipment, UL 508, and Industrial Control Equipment, CSA C22.2 No. 14.

g) Bus bar clamps covered by the Standard for Portable Power-Distribution Equipment, UL 1640.

h) Portable power distribution units covered by the Standard for Portable Power-Distribution Equipment, UL 1640.

2 Reference Publications

2.1 Products covered by this Standard shall comply with the referenced installation codes and standards noted in this clause as appropriate for the country where the product is to be used. When the product is intended for use in more than one country, the product shall comply with the installation codes and standards for all countries where it is intended to be used.

2.2 Where reference is made to any Standards, such reference shall be considered to refer to the latest editions and revisions thereto available at the time of printing, unless otherwise specified.

CSA Standards

C22.1-2009,
Canadian Electrical Code, Part I (CEC)

CAN/CSA C22.2 No. 0.17-00 (R2009),
Evaluation of Properties of Polymeric Materials

CAN/CSA C22.2 No. 65-03 (R2008),
Wire Connectors

CAN/CSA C22.2 No.94.2-07,
Standard for Enclosures for Electrical Equipment, Environmental Considerations

UL Standards

UL 50E
Standard for Enclosures for Electrical Equipment, Environmental Considerations

UL 94
Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 486A-486B
Wire Connectors

UL 486E
Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

UL 746A
Polymeric Materials - Short Term Property Evaluations

UL 746B
Polymeric Materials - Long Term Property Evaluations

UL 1640
Portable Power Distribution Units

ASTM (American Society for Testing and Materials)

D 570
Standard Test Method for Water Absorption of Plastics

E28
Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus

IEEE Standards

IEEE 837
Standard for Qualifying Permanent Connections Used in Substation Grounding

NFPA (National Fire Protection Association)

NFPA 70
National Electrical Code

3 General

3.1 Components

3.1.1 Except as indicated in 3.1.2, a component of a product covered by this Standard shall comply with the requirements for that component. See Clause 2 for a list of standards covering components generally used in the products covered by this Standard. A component shall comply with the CSA or UL standards as appropriate for the country where the product is to be used.

3.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this Standard, or

b) Is superseded by a requirement in this Standard.

3.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

3.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3.2 Units of measurements

3.2.1 The values given in SI (metric) units shall be normative. Any other values given shall be for information purposes only.

4 Definitions

4.1 The following terms and definitions apply in this Standard.

Attachment plug – a device consisting of a male contact and a housing, intended to be attached to one cable.

Configuration, Locking-type – a configuration that requires a motion other than a straight push or pull or requires a deliberate mechanical action such as that required by a threaded collar, a cam, or a bayonet, to connect or separate it when used with its mating part.

Cord connector – a device consisting of a female contact and a housing, intended to be attached to one cable and intended to supply electrical equipment.

Contact – a conductive element in a wiring device that mates with a corresponding element to provide an electrical path.

Enclosure – the part of a wiring device or accessory which renders inaccessible all or any parts of the device that may otherwise present a risk of electrical shock and which provides protection to internal components against specified external conditions.

Grounding path – a path between the grounding pin, or contact and the grounding terminal.

Inlet (Power inlet) – a device consisting of a male contact and a housing, incorporated in, or fixed to, the utilization equipment.

Insulation, Electrical – the insulation necessary for the proper functioning of the product wiring device and for basic protection against electrical shock.

Insulator – that portion of a device that provides for separation and for support of live parts.

Mounting housing – that portion of a panel inlet or outlet that is used to affix the inlet or outlet to a panel.

Outlet (Receptacle) – a device consisting of a female contact and a housing, intended to provide power to an inserted plug, and that is installed as a fixed outlet or on equipment.

Receptacle – see **Outlet (Receptacle)**

Single pole separable connector – a device, either inlet, outlet, or cable-connected, for the connection of single conductor cables in the form of pin and sleeve configuration.

Terminal – a conductive part provided for the attachment of a conductor to a wiring device.

Terminal, Bar – a terminal which is intended to secure a cable lug or bar by means of a bolt or bolts.

Terminal, Crimp – a terminal in which the conductor is inserted into a hole or cavity, and compressed by a tool, and permanently deformed to attach the conductor.

Terminal, Double set screw – a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of two set screws. The clamping pressure may be applied directly by the shank of the screws or through an intermediate clamping member or shim to which pressure is applied by the shank of the screws.

Terminal, Set screw – a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of a set screw. The clamping pressure may be applied directly by the shank of the screw or through an intermediate clamping member or shim to which pressure is applied by the shank of the screw.

Terminal, Threaded stud – a terminal which is intended to secure a cable lug or bar by means of a nut or nuts.

5 Construction

5.1 General

5.1.1 The ratings mentioned throughout the Standard represent the maximum current and voltage for a device under continuous duty. A device is considered to be for use with either alternating or direct current unless the rating includes a marking to restrict the use to alternating current. See 7.1.1 d) and 7.3.

5.1.2 Devices shall be rated in amperes and in volts, ac or dc, or both ac and dc.

5.2 Mating and intermateability

5.2.1 Device configurations that are intermateable and identified in Annex B shall comply with all applicable dimensions as shown and be so identified as described in 7.1.1 b).

5.2.1.1 Series 15 and 16 rigid female and male housings shall be restricted to panel mount devices only.

5.2.2 Devices not covered in Annex B shall not be intermateable with those devices in Annex B.

5.3 Insulating material

5.3.1 An enclosure or insulator in or on which live parts are mounted shall be of an insulating material acceptable for the particular application.

5.3.2 Vulcanized fiber may be used for insulating washers, separators, and barriers, but not as the sole support for live parts. The material shall be moisture-resistant in accordance with the Moisture Absorption Resistance Test, 6.6.

5.3.3 Except as indicated in 5.3.4 – 5.3.8, a polymeric material used for electrical insulation, an internal barrier necessary to maintain electrical spacings, or an enclosure of live parts:

a) Shall have a flame class rating of HB, V-2, V-1, V-0, VTM-2, VTM-1, VTM-0, 5VA, or 5VB in accordance with the requirements of the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94 and CSA C22.2 No. 0.17.

b) Shall comply with the requirements in Comparative Tracking Index, 6.2, and Glow Wire Test, 6.3.

5.3.4 A small part meeting all the following criteria need not have a flame class rating, nor does it need to comply with the requirements in 5.3.3:

a) Its volume does not exceed 2 cm^3(0.122 cubic inch),

b) Its maximum dimension does not exceed 3 cm (1.18 inches), and

c) Its location is such that it cannot propagate flame from one area to another or act as a bridge between a possible source of ignition and other ignitable parts.

5.3.5 Fiber or similar material that is equal to or less than 0.25 mm (0.010 inch) thick need not have a flame class rating nor comply with the requirements in 5.3.3.

5.3.6 A polymeric material having a maximum Comparative Tracking Index (CTI) performance level class of 3 (175) need not comply with the Comparative Tracking Index Test, 6.2.

5.3.7 A polymeric material having Hot Wire Ignition (HWI) performance level class values not greater than those shown in Table 1for the applicable flammability classification need not comply with the Glow Wire Test, 6.3.

5.3.8 A polymeric material having High-Current Arc Resistance to Ignition (HAI) and Hot Wire Ignition (HWI) performance level class values not greater than those shown in Table 1 need not comply with the High-Current Arc Resistance to Ignition Test, 6.4.

Table 1
Hot wire ignition (HWI) and high-current arc resistance to ignition (HAI) ratings of insulating materials

Flammability classification[a]	HWI[b,d]		HAI[c,d]	
	Mean ignition time (s)	PLC	Mean no. of arcs	PLC
V-0, VTM-0	7 and up to 15	4	15 and up to 30	3
V-1, VTM-1[e]	15 and up to 30	3	15 and up to 30	3
V-2, VTM-2	15 and up to 30	3	15 and up to 30	3
HB	30 or more	2	60 or more	1

[a] Flammability classification – Described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

[b] Hot Wire Resistance to Ignition – Described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

[c] High-Current Arc Resistance to Ignition – Described in UL 746A.

[d] Mean ignition time and mean no. of arcs to be used to evaluate Filament Wound Tubing, Industrial Laminates, Vulcanized Fiber, and similar polymeric materials only. All other materials shall be judged using the performance level class values.

[e] A polymeric material subjected to the flammability test with either the 12 mm or 20 mm (3/4- inch) flame in accordance with 5.3.3 shall comply with the PLC for a V-1 rating.

5.3.9 A polymeric material used for electrical insulation, an internal barrier necessary to maintain electrical spacings, or an enclosure of live parts shall have the temperature index ratings shown in Table 2 for the specific application of the insulating material. For materials with other than VTM flammability classifications, the material shall be evaluated using the specimen thickness employed in the end product or nominal 3.2 mm (1/8 inch) thickness, whichever is greater.

Exception: The following generic materials having readings of 65 or less on the Shore Durometer D scale (when measured for 5 seconds at an ambient temperature of 23.0 ±2.0°C (73.4 ±3.6°F)) are acceptable for use at 60°C (140°F) based on their successful completion of the appropriate accelerated aging test described in Accelerated Aging Tests, 6.8:

a) Ethylene/Propylene/Diene (EPDM)

b) Natural Rubber (NR)

c) Neoprene (Chloroprene Butadiene) Rubber (CBR)

d) Nitrile Rubber (NBR)

e) Polyvinyl Chloride (PVC) and its copolymers

f) Silicone Rubber (SIR)

g) Styrene (Butadiene) Rubber (SBR)

h) Thermo Elastomeric [TEE; includes Thermoplastic Elastomers (TPE) and Ethylene Propylene Thermoplastic Rubber (EPTR)]

Table 2
Minimum relative thermal indices of insulating materials

Application	Minimum relative thermal index[a] – degrees C		
	Electrical	Mechanical[b]	
		With impact	Without impact
Permanently-Wired Devices (Panel inlets, panel outlets)	80	60	80
Cord-connected and direct plug- In devices (including attachment plugs and cord connectors)	60	60	60

[a]Relative Thermal Index – Described in Polymeric Materials – Long Term Property Evaluations, UL 746B and CSA C22.2 No. 0.17.

[b]For filament wound tubing, industrial laminates, vulcanized fiber and similar polymeric materials, the minimum RTO for Mechanical shall be the values specified for Electrical.

5.3.10 Pliable, molded natural or synthetic rubber, or a combination thereof, or a composition whose basic constituent is vinyl chloride or a copolymer of vinyl chloride and vinyl acetate, may be employed for the body of:

a) A plug,

b) A connector,

c) An inlet,

d) An outlet,

e) An adaptor, or

f) An accessory.

5.3.10.1 Series 15 and 16 rigid female and male housings shall be restricted to panel mount devices only.

5.3.11 Devices that have solid bodies or hollow-shell plug bodies of molded polystyrene, cellulose acetate, ethyl cellulose, or nylon may be found acceptable after investigation of properties such as mechanical strength, resistance to impact, and stability at elevated temperatures.

5.3.12 A sealing compound shall be insulating, waterproof, and shall not soften at a temperature of 65°C (149°F). A determination of the softening point of a sealing compound shall be made in accordance with the Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus, ASTM E28.

5.3.13 Sulphur is not acceptable as a sealing compound.

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5.4 Resistance to corrosion

5.4.1 Parts of iron or steel, other than stainless steel, or aluminum shall be protected against corrosion, in accordance with the Resistance to Corrosion Test, 6.13.

5.4.2 Iron or steel other than machine screws, washers, nuts, and stainless steel parts shall be protected against corrosion.

5.5 Current-carrying parts

5.5.1 Iron or steel, plated or unplated, shall not be used for parts that are depended upon to carry current, except that stainless steel may be employed for a part not subject to arcing.

5.5.2 A steel that is corrosion-resistant (stainless) or is protected against corrosion by zinc or tin plating or an equivalent protective coating may be used for terminal nuts and screws. Terminal nuts and screws are considered not to be depended upon to carry current.

5.5.3 A current–carrying part shall be prevented from moving relative to the surface on which it is mounted if such movement would adversely affect the performance of the device.

5.5.4 Uninsulated live parts shall be secured in place so that spacings comply with the requirement in 5.9.1.

5.6 Grounding and dead-metal parts

5.6.1 The following grounding parts shall be of plated or unplated copper or of a copper–based alloy:

a) The grounding contact;

b) The grounding path through an attachment plug, or connector, except for a metal housing or armor; and

c) The grounding path through a panel inlet or panel outlet to the mounting means.

5.6.2 A rivet, bolt, or clamp that is used to secure parts in the grounding path, but which is not an essential conductor in the grounding path, may be of steel or its equivalent.

5.6.3 A copper–base alloy rivet that is used to secure parts in the grounding path, or that forms a part of the grounding path, shall not contain less than 80 percent copper.

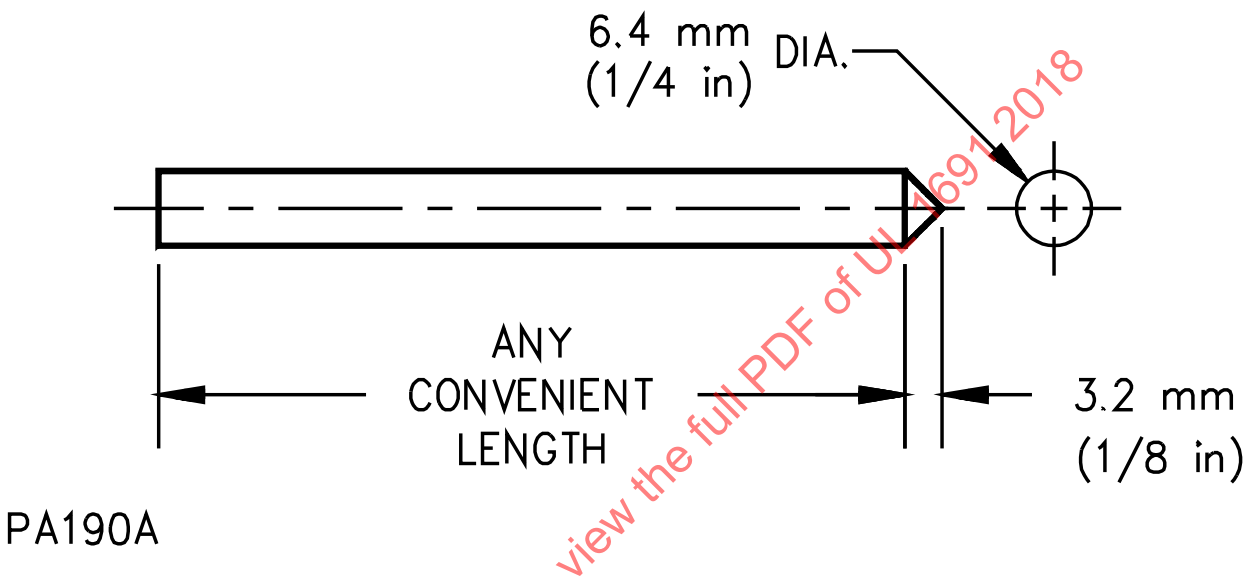
5.6.4 Grounding and other dead metal parts shall be secured in place so that a reduction in spacings below those required in 5.9 is not likely.

5.6.5 Accessible metal parts shall be insulated from live parts and uninsulated conductors so they shall not become energized.

5.7 Contacts

5.7.1 Female contacts and associated live parts in the contact opening of a device that can be touched by the probe illustrated in Figure 1 shall be recessed from the plane of the opening by a distance not less than ¼ of the minimum opening of the insulator, or 1.2 mm minimum (3/64 inch), whichever is greater, for devices rated less than 250V, and 3.2 mm minimum (1/8 inch) for devices rated greater than 250V. The plane of measurement for the depth of the recess shall be the end of the insulator free of burrs or flashing.

Figure 1
Probe



5.7.2 The probe in Figure 1 shall be inserted point first as far as possible in the opening without distorting the perimeter of the opening.

5.7.3 Devices having openings that close upon removal of the attachment plug are not subject to the requirements in 5.7.1.

5.8 Terminals

5.8.1 If a device is intended for the connection of conductors, a means shall be provided for such connection.

5.8.2 The means for connection mentioned in 5.8.1 shall include a set screw terminal, a threaded stud type terminal complete with nut and pressure washers, or fastening of the conductor by means of welding or crimping.

5.8.3 A terminal provided for the field connection of a grounding conductor shall employ a mechanical clamping means that does not depend solely upon solder for the connection of the conductor.

5.8.4 Other forms of construction may be accepted if the mechanical features and current-carrying capability are equivalent to those of one of the connections described in 5.8.2.

5.8.5 A terminal plate for a soldering lug or pressure – wire connector shall be at least 0.76 mm (0.030 inch) thick and shall have no fewer than two full threads in the metal for a terminal screw.

5.8.6 In the United States, panel inlets and panel outlets employing pressure-wire connectors shall comply with the applicable requirements in the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

In Canada, the terminals of a device shall comply with the applicable requirements of Terminal Blocks, CSA C22.2 No. 158.

5.8.7 Attachment plugs and connectors employing either an irreversible tool-applied crimp-type connection or set-screw type pressure wire connector terminals shall comply with the Standard for Wire Connectors, NMX-J-543-ANCE/CSA C22.2 No. 65/UL 486A-486B.

5.8.8 The tightening torque for the set-screw type, bar, and stud type terminals shall be specified by the device manufacturer and shall be marked as described in 8.1. The specified tightening torque shall not be less than 90 percent of the value employed in the static heating test in UL 486E for the minimum and maximum wire size corresponding to the ampere rating of the device.

5.8.9 A lesser torque value may be assigned if the connector is investigated in accordance with NMX-J-543-ANCE/CSA C22.2 No. 65/UL 486A-486B or UL 486E using the lesser assigned torque value.

5.9 Spacings

5.9.1 There shall be a spacing through air or over surface of not less than 1.2 mm (3/64 inch) for a device rated 250 V or less, and not less than 3.2 mm (1/8 inch) for a device rated greater than 250 V, between uninsulated live parts and dead-metal parts that are likely to be grounded or exposed to contact by persons when the device is installed as intended.

5.9.2 The dead metal mentioned in 5.9.1 includes a metal surface on which the device is mounted in the intended manner. A dead-metal screw head, rivet, or the like is not considered to be exposed to contact by persons after the device is installed in the intended manner, if the dead metal is located in a hole not larger than 7.1 mm (9/32 inch) in diameter and recessed not less than 4.8 mm (3/16 inch).

5.9.3 In measuring a spacing, an isolated dead-metal part interposed between live parts of opposite polarity, or between a live part and a grounded or exposed dead-metal part, is considered to reduce the spacing by an amount equal to the dimension of the isolated dead-metal part in the direction of the measurement.

5.10 Assembly

5.10.1 A device shall be capable of being readily wired as intended.

5.10.2 Electrical contact shall be reliably maintained at any point at which a connection is made between current-carrying parts.

5.10.3 An outlet device shall have live parts protected against unintentional contact by persons when the outlet is assembled and installed as intended.

5.10.4 Means shall be provided for securely attaching the contact of a panel inlet or outlet to the mounting base. The contact shall be prevented from turning with respect to the mounting base.

5.10.5 Panel inlets and outlets shall be provided with at least two independent mechanical means of fixation to prevent rotation or movement when assembled to a panel in the intended manner.

5.10.6 A metal-covered device intended for connection to a flexible cord shall be provided with an insulating bushing.

5.11.2 relocated as 5.10.6

5.10.7 A bushing made of hard fiber is acceptable if the fiber is not less than 1.2 mm (3/64 inch) thick and it is so formed and secured in place that it will not be affected by ordinary conditions of moisture.

5.11.3 relocated as 5.10.7

5.10.8 If the metal covering of a device is not in proximity to the cord-entry hole, and the insulating material of which the connector is made serves as a smooth, well-rounded bushing for a flexible cord or cable, a separate bushing is not required.

5.11.4 relocated as 5.10.8

5.10.9 A metal cord grip may be provided on a cord-connected device. A metal cord grip shall be suitable for the flexible cord or cable as specified by the manufacturer. A metal-covered device with a metal cord grip is not required to have an insulating bushing.

5.11.5 relocated as 5.10.9

5.10.10 A cord or cable connected device shall comply with the Cord and Cable Secureness Test, 6.14.

5.11.6 revised and relocated as 5.10.10

5.10.11 The cord entry of a cord or cable connected device shall accommodate the maximum and minimum diameters of the range of cord or cable sizes and types identified by the manufacturer. The range shall include a wire size with at least a current-carrying capacity equal to the marked electrical rating of the connector.

5.11.7 revised and relocated as 5.10.11

5.11 Cord entry and strain relief

5.11.1 *Deleted*

5.11.2 *Relocated as 5.10.6*

5.11.3 *Relocated as 5.10.7*

5.11.4 *Relocated as 5.10.8*

5.11.5 *Relocated as 5.10.9*

5.11.6 *Revised and relocated as 5.10.10*

5.11.7 *Revised and relocated as 5.10.11*

5.12 Enclosures

5.12.1 Series 15, 16, 18 devices as shown in Annex B shall have a minimum enclosure rating of Type 3R when mated, and be marked accordingly.

5.12.2 An enclosure marked with one or more environmental enclosure type designations shall comply with the applicable requirements in 6.15 and 7.1.1 e) and f).

5.13 Adapters

5.13.1 Identified Adapters:

a) Tapping Tee (Two-Fer) – One male contact to two female contacts for the purpose of connecting multiple loads.

b) Paralleling Tee – Two male contacts to one female contact for purpose of paralleling conductors.

c) Three-Fer – One male contact to three female contacts for the purpose of connecting multiple loads.

d) Squid – One male contact to multiple female contacts.

e) Reverse Squid – One female contact to multiple male contacts.

f) Reverse Three-Fer – Three male contacts to one female contact for purpose of paralleling conductors.

g) Male-to-Male – (Gender-reversing male or Turn-around male-to-male) One male contact to one male contact.

h) Female-to-Female – (Gender-reversing female or Turn-around female-to-female) One female contact to one female contact.

i) Configuration Converter – A device converting from one configuration of contact to another.

5.13.2 Adapters shall have a rating equal in capacity to the devices with which they are intended to be mated.

5.13.3 Male-to-Male and Female-to-Female adapters shall be:

a) Colored green or green/yellow and marked, ″For grounding use only″; or

b) Colored white and marked, ″For white conductor use only″.

5.13.4 Adapters colored green or green/yellow shall be tested in accordance with the Short Circuit Test, 6.11.

6 Tests

6.1 Representative devices

6.1.1 Unless stated otherwise, a minimum of three representative devices shall be used for each test.

6.1.2 All tests shall be conducted on mating pairs.

6.2 Comparative tracking index test

6.2.1 A polymeric material used for electrical insulation, an internal barrier necessary to maintain electrical spacings, or an enclosure of live parts tested in accordance with the Comparative Tracking Index and Comparative Tracking Performance Level Class of Electrical Materials test described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A or Evaluation of Properties of Polymeric Materials, CSA C22.2 No. 0.17, shall have a performance level class value not greater than 3. See also 5.3.3.

6.2.2 Notwithstanding 6.2.1, a polymeric material having a maximum Comparative Tracking Index (CTI) performance level class of 3 or a minimum CTI value of 175 need not be subjected to this test.

6.3 Glow wire test

6.3.1 A polymeric material used for electrical insulation, an internal barrier necessary to maintain electrical spacings, or an enclosure of live parts shall be tested in accordance with the requirements of 6.3.2 in order to determine its resistance to ignition from overheated conductors caused by circuit overloads.

6.3.2 Notwithstanding 6.3.1, a polymeric material having Hot Wire Ignition (HWI) performance level class values not greater than those shown in Table 1for the applicable flammability classification need not be subjected to the Glow Wire Test, 6.3.3.

6.3.3 Devices shall be subjected to the Glow-Wire Resistance to Ignition Test described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A or CSA C22.2 No. 0.17. As a result of this test, there shall not be ignition of the insulating material during 30 seconds of application of the probe.

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6.4 High-current arc resistance to ignition test

6.4.1 A polymeric material used for electrical insulation, an internal barrier necessary to maintain electrical spacings, or an enclosure of live parts when tested as described in 6.4.2 – 6.4.6 shall not ignite within the number of arcs specified in Table 3 for the flame class of the insulating material. In addition, there shall be no dielectric breakdown caused by formation of a permanent carbon conductor path.

Table 3
Arcing criteria for the high-current arc resistance to ignition test

Flame class	Number of arcs
94HB	60
94V-2, 94VTM-2	30
94V-1, 94VTM-1, 94-5VA, 94-5VB	30
94V-0, 94VTM-0	15

6.4.2 When preparing devices for test, the condition that will cause the greatest arcing near the material being tested in the device shall be simulated. For example, if the material being tested is used in the face of an attachment plug, one line blade shall be connected to the test circuit described in 6.4.3.

6.4.3 The test circuit shall provide test currents and test voltages equal to the current and voltage ratings of the device to be tested. The test arc shall be established between the live parts and any adjacent part where breakdown is likely to occur. The arc shall be used to attempt to ignite materials forming parts of the enclosure or to ignite materials located between the parts of different potential. The arc shall be established by means of a copper or stainless steel conductive probe. The conductive probe shall be used to break through insulation, create arc tracking or create a carbon build-up across the surface of the insulating material at the rate of 30 – 40 arc separations per minute. The arc length developed with the probe shall not exceed the spacing specified in 5.9.

6.4.4 Immediately following the completion of the arcing portion of the test, the device shall be subjected to a 50 to 60 Hz essentially sinusoidal potential applied as described in 6.4.5 between live parts of opposite polarity and between live parts and dead-metal parts. The test potential shall equal twice the rated voltage of the device plus 1000 V.

6.4.5 The device shall be tested by means of a 500 VA or larger capacity transformer whose output voltage is essentially sinusoidal and can be varied. The applied potential shall be increased from zero until the required test level is reached, and shall be held at that level for one minute. The increase in the applied potential shall be at a uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter.

6.4.6 If the output of the test-equipment transformer is less than 500 volt-amperes, the equipment shall include a voltmeter in the output circuit to indicate the test potential directly.

6.5 Mold stress relief test

6.5.1 As a result of temperature conditioning specified in 6.5.3, there shall not be any warpage, shrinkage or other distortion that results in any of the following:

a) Making uninsulated live parts, other than exposed wiring terminals, or internal wiring accessible to contact by the probe illustrated in Figure 1.

b) Defeating the integrity of the enclosure so that acceptable mechanical protection is not afforded to the internal parts of the device.

c) Interference with the operation, function or installation of the device. The outlet openings of a female device shall be capable of receiving a fully inserted attachment plug of the intended configuration.

d) A condition that results in the device not complying with the strain relief requirements, if applicable.

e) A reduction of spacings between uninsulated live parts of opposite polarity, uninsulated live parts and accessible dead or grounded metal below the minimum acceptable values.

f) Any other evidence of damage that could increase the risk of fire or electric shock.

6.5.2 Notwithstanding 6.5.1, devices employing only thermosetting materials need not be subjected to this test.

6.5.3 Mating devices shall be inserted into three of the six female devices and all shall be placed in a circulating air oven maintained at a temperature of 70°C (158°F) for 7 hours. The devices shall be removed from the oven and allowed to cool to room temperature before determining compliance.

6.5.4 Immediately following the completion of this test, the devices shall be subjected to a repeated dielectric voltage withstand test as described in Dielectric Voltage Withstand Test, 6.7. The devices need not be subjected to the humidity conditioning described in 6.7.3.

6.6 Moisture absorption resistance test

6.6.1 Moisture – resistance insulating materials shall not absorb more than 6 percent of water by mass.

6.6.2 Notwithstanding 6.6.1, a material tested in accordance with the Standard Method for Measuring Water Absorption of Plastics (ASTM D 570) described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A, need not be subject to this test.

6.6.3 The material shall be:

a) Dried at 105 ± 5°C for 1 hour;

b) Weighed (W1);

c) Immersed in distilled water at 23 ± 1°C for 24 hours;

d) Removed from the distilled water and the excess surface moisture wiped off; and

e) Reweighed (W2).

6.6.4 The moisture absorbed by the material shall be calculated as:

$$\frac{W_2 - W_1}{W_1} \times 100\%$$

6.7 Dielectric voltage-withstand test

6.7.1 All devices shall withstand without breakdown a 50 – 60 Hz essentially sinusoidal potential applied as described in 6.7.4 for one minute between live parts and metal foil wrapped around the enclosure immediately following the humidity conditioning described in 6.7.3.

6.7.2 Notwithstanding 6.7.1, devices employing polymeric materials consisting only of ceramic, thermoset, thermoplastic or elastomeric materials need not be subjected to the humidity conditioning.

6.7.3 Mating devices shall be inserted into the contact openings of three of the six female devices. The devices shall then be placed into an environmental chamber and sequentially subjected to each of the following conditions:

a) 4 hours at a temperature of 75 ± 2°C (167 ± 3.6°F) at a relative humidity of 92 ± 3 percent.

b) 16 hours at a temperature of 75 ± 2°C (167 ± 3.6°F) at a relative humidity of 40 ± 3 percent.

c) 4 hours at a temperature of 30 ± 2°C (86 ± 3.6°F) at a relative humidity of 60 ± 3 percent.

6.7.4 Upon completion of the humidity conditioning, the device shall be tested by means of a 500 VA or larger capacity transformer whose output voltage is essentially sinusoidal and can be varied. The applied potential shall be increased from zero until the required test level is reached, and shall be held at that level for one minute. The increase in the applied potential shall be at a uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter. The test potential shall be 3000 V for all devices.

6.7.5 If the output of the test-equipment transformer is less than 500 volt- amperes, the equipment shall include a voltmeter in the output circuit to indicate the test potential directly.

6.8 Accelerated aging test

6.8.1 Rubber compounds

6.8.1.1 A molded-rubber device shall not show any apparent deterioration and no greater change in hardness than ten numbers as the result of exposure for 70 hours in a full-draft circulating-air oven at a temperature of 100.0 ± 2.0°C (212.0 ± 3.6°F).

6.8.1.2 The hardness of the rubber shall be determined as the average of five readings with an appropriate gauge, such as the Rex hardness gauge or the Shore durometer. The device shall be allowed to rest at room temperature for four or more hours after removal from the oven. The hardness shall be determined again as the average of five new readings. The difference between the average original hardness reading and the average reading taken after exposure to the heat conditioning is the change in hardness.

6.9 PVC compounds

6.9.1 A device having a body of molded polyvinyl chloride or a copolymer thereof, shall not show any cracks, discoloration, or other visible signs of deterioration as the result of exposure for 96 hours in a full – draft circulating- air oven at a temperature of 100 ± 2.0°C (212.0 ± 3.6°F).

6.10 Insulation resistance test

6.10.1 When determined as described in this clause, the insulation resistance shall not be less than 100 megohms between:

a) Live parts and dead-metal parts that are exposed to contact by persons or that may be grounded in service; and

b) Live parts and any surface of insulating material that is exposed to contact by persons or that may be in contact with ground in service.

6.10.2 All rubber parts shall be kept for at least 48 hours at room temperature before being subjected to the test mentioned in 6.10.3. The insulation resistance measurement shall be made on rubber and similar materials of any color. Other materials shall be tested if they contain free carbon in such quantity that it renders the material grey or black.

6.10.3 To determine compliance with the requirement in 6.10.1, the insulation resistance shall be measured by a magneto megohmmeter that has an open-circuit output of 500 V or by equivalent equipment.

6.10.4 The use of a megohmmeter between metal parts requires no special clarification or instruction. However, in measuring insulation resistance to the surface of an insulating material, an electrode shall be applied to the insulating material as described in 6.10.5.

6.10.5 A quantity of copper coated lead drop shot, approximate diameter 0.10 inch or 2.5 mm, shall be placed in a container that is open at the top or has metal foil wrapped around the enclosure. After cord holes or other openings through which the shot could enter have been carefully plugged with a high-resistance insulating material, the device shall be immersed in the shot so that the shot serves as an electrode in contact with the surface to which the test shall be applied.

6.11 Short-time current test

6.11.1 All devices that are designated and so identified for connection to the identified grounding (green/grounding) circuit conductor shall not crack, break, or melt when subjected to the test current and time as specified in Table 4. In addition, the mated pairs shall maintain electrical continuity after the application of the short-time current.

6.11.2 To determine compliance with the requirement in 6.11.1, three representative mated pairs shall be tested.

6.11.3 Devices shall be wired according to the manufacturer's instructions using the maximum specified conductor gauge size (AWG or kcmil), and not less than 610 mm (2 ft) in length.

6.11.4 If the device is designed to be assembled to a conductor by means of more than one type of identified tool, the device shall be additionally tested using all identified tool assembly methods.

6.11.5 If the device is designed to be assembled to a conductor by means of a wire connector (lug), the device shall be installed on a length of cable of a conductor gauge size (AWG or kcmil) corresponding to the maximum continuous current-carrying capacity for the device and not less than 610 mm (2 ft) long. The wire connector (lug) used shall be suitable for the application.

6.11.6 For the purpose of this test, each device shall be mated as intended to create one path of current flow. Devices such as adapters and multiple-inlet or multiple-outlet or gender-adapting devices shall be wired or mated to create one path of current flow.

6.11.7 Each assembly shall be subjected to the test current and associated time as shown in Table 4. All three mated pairs shall be tested individually. When the conductor cannot maintain minimum current as defined in Table 4, the current may be reduced to a lesser value, but not less than 5000 A, provided the test time is increased to a higher value, not to exceed 1 min. The values for test current and time shall be calculated using the formula in Table 4.

Table 4
Short-time test currents

Equipment grounding conductor size		Time, s	Current, a
AWG or kcmil	(mm^2)		
6	(13.3)	6	1530
4	(21.2)	6	2450
3	(26.7)	6	3100
2	(33.6)	6	3900
1	(42.4)	6	4900
1/0	(53.5)	9	5050
2/0	(67.4)	9	6400
3/0	(85.0)	9	8030
4/0	(107)	9	10100
250 kcmil	(127)	9	12000
300	(152)	9	14300
350	(177)	9	16700
400	(203)	9	19100
500	(253)	9	23900
600	(304)	9	28700
700	(355)	9	33500

Table 4 Continued on Next Page

Table 4 Continued

Equipment grounding conductor size		Time, s	Current, a
AWG or kcmil	(mm^2)		
750	(380)	9	35900
800	(405)	9	38300
900	(456)	9	43100
1000	(507)	9	47900

Note: Test current values are derived from the following formula and have been rounded. To derive test current values for electrode materials other than the ones listed above, see Annex C of the Standard for Qualifying Permanent Connections Used in Substation Grounding, IEEE 837.

$$I = A\sqrt{\frac{tn\,\frac{K_o + T_m}{K_o + T_a}}{\beta * t}}$$

in which:

T_m = 1083°C for melting point for copper

T_a = 40°C = ambient temperature

I = short-time current (amperes) in kA

A = conductor cross-section in mm^2

t = time (s)

K_o = reciprocal of thermal coefficient of resistivity at 0°C = 234 for copper

β = material constant = 19.8 for copper

6.11.8 Upon completion of the applied test current and time, each individually tested assembly shall maintain continuity, when measured between a point on the mating surface of the device contact and a point 6.4 mm (1/4 in) from the point of entry of the cable into the device or the wire connector (lug). For devices such as adapters and multiple-inlet or multiple-outlet or gender-adapting devices, continuity is checked between corresponding points that were subjected to short-time current flow, on the mating surface of the device contacts.

6.11.9 Indicating means, such as an ohmmeter, battery-and-buzzer combination, or the like, may be used to determine whether continuity exists.

6.11.10 If the test conductor carrying the short-time current opens and fails to carry the required test current for the specified time in Table 4, the test is considered inconclusive. The test shall be repeated using an alternate grounding conductor capable of carrying the required current for the specified time.

6.12 Temperature test

6.12.1 The temperature rise of a device measured at the points described in 6.12.2 shall not exceed 30°C when the device is carrying its maximum rated current. This temperature rise is based on devices intended to be wired with conductors rated 60°C or 75°C. A temperature rise of 45°C is permitted when the device is intended to be wired with conductors rated 90°C or higher and so marked. Devices intended for use with conductors rated 90°C or higher and so marked shall not intermate with similar devices not so marked. See 7.5.1.

6.12.1.1 When a busbar is used in temperature testing, the size of the busbar shall be selected as shown in Table 4A for the ampere rating of the device under test.

Table 4A
Busbar dimensions

Range of test current, A	Maximum cross-section, mm (in)
0 – 50	3.2 X 12.7 (1/8 X 1/2)
51 – 125	3.2 X 25 (1/8 X 1)
126 – 225	3.2 X 48 (1/8 X 1-7/8)
226 – 400	6.4 X 38 (1/4 X 1-1/2)
401 – 600	6.4 X 50 (1/4 X 2)
601 – 800	6.4 X 76 (1/4 X 3)

6.12.2 The temperature measurement mentioned in 6.12.1 shall be made on the wiring terminals of the device if they are accessible for the mounting of thermocouples. If the wiring terminals are inaccessible, or if the device has no wiring terminals, temperatures shall be measured at points as close to the face of the device as possible on the pin of an attachment plug inserted in the connector or panel outlet.

6.12.3 The temperature test shall continue for 4 hours even through stabilized temperatures can be attained in a somewhat shorter interval of time. The generation of heat from sources other than the female contact shall be minimized as much as possible. The contact of the device being tested shall be mated to its mating device. The terminal shall be tightened to the manufacturer's specified torque, see 8.1.1, or using the manufacturer's specified crimping tool, see 8.2.1.

6.12.4 Temperature readings shall be obtained by means of thermocouples consisting of 28 – 32 AWG (0.08 – 0.032 mm^2) iron and constantan wires. It is a common practice to employ thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wires with a potentiometer type of indicating instrument. This equipment will be used if a referee measurement of temperature is necessary.

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6.13 Resistance to corrosion

6.13.1 Ferrous parts, including enclosures, shall be adequately protected against corrosion.

6.13.2 Compliance shall be checked by the following test. All grease shall be removed from the parts to be tested, by immersion in ethyl acetone, acetone or methyl ethyl ketone for ten minutes. The parts shall then be immersed for 10 minutes in a 10 percent solution (by weight) of ammonium chloride in water at a temperature of 20± 5 °C.

6.13.3 The parts shall then be dried for 10 minutes in a heating cabinet at a temperature of 100 ± 5 °C, and their surfaces shall not show any signs of rust.

6.13.4 Traces of rust on sharp edges and yellowish finish removable by rubbing shall be ignored.

6.13.5 Small helical springs and the like, and inaccessible parts exposed to abrasion, shall be considered protected against corrosion by a coating of grease. Such parts shall be tested only when the effectiveness of the grease film is in doubt, and the test shall then be made without previous removal of the grease.

6.14 Cord and cable secureness test

6.14.1 A cord or cable connected device shall not show any evidence of damage to the flexible cord or cable, the enclosure of live parts, the termination of the conductor to the contact, or grounding path integrity, after the force specified in Table 5 is applied and removed. It shall be tested using both the maximum and minimum diameter flexible cord or cable that the device is designed to accommodate. After being subjected to each test described and with the force removed, there shall not be any axial displacement of the supply conductors, conductor insulation, or outer jacket of the flexible cord or cable from the assembled condition exceeding the maximum allowed displacement as specified in Table 5.

Table 5
Cord or cable secureness test values

Device rating, a	Force		Torque		Maximum displacement
	lbf	N	ft-lb	N•m	mm (inches)
15	30	133	0.3	0.41	2.4 (3/32)
16 – 20	30	133	0.4	0.54	2.4 (3/32)
21 – 35	75	333	0.5	0.68	2.4 (3/32)
36 – 70	150	667	1.0	1.4	2.4 (3/32)
71 – 125	150	667	2.0	2.7	2.4 (3/32)
126 – 200	150	667	4.0	5.4	2.4 (3/32)
201 – 400	300	1334	8.0	10.8	4.8 (3/16)
401 – 800	600	2668	12.0	16.3	4.8 (3/16)

6.14.2 The device shall be assembled as intended, including termination of the conductor to the contact, onto a 305 mm (12 inch) or longer length of flexible cord or cable. Screws, nuts, or other hardware shall be tightened according to the manufacturer's instructions.

6.14.3 The device shall be held firmly in place. The force shall be applied gradually and sustained for a period of 1 minute to the flexible cord or cable, at a point not less than 150 mm (6 inch) from the cord or cable entry or grip, in a direction perpendicular to the plane of the opening and in line with the flexible cord or cable.

6.14.4 Following the pull, a torque shall also be applied to the flexible cord or cable at a point 150 mm (6 inch) from the cord or cable entry or grip as specified in Table 5 for 1 minute in the direction least favorable to the device construction.

6.15 Enclosure tests for environmental protection

6.15.1 Plugs, receptacles, and connectors requiring a degree of moisture protection shall not permit the entrance of water when subjected to the tests associated with their classifications, as described in this clause. Water shall not enter the devices to any appreciable extent, shall not collect on the interior of the box, shall not interfere with the intended performance of the device, and shall not reach live parts.

Exception: Enclosures for mounting devices may be evaluated as a specific enclosure type in accordance with the Enclosure Tests for Environmental Protection, in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E/CSA C22.2-94.2/NMX-J-235/2-ANCE.

6.15.2 A device enclosure shall be subjected to the tests specified in Table 50.1 in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E/CSA C22.2-94.2/NMX-J-235/2-ANCE, and shall comply with the construction requirements applicable to an enclosure of the type number or numbers with which it is marked in accordance with Table 6.

6.15.3 A watertight connection at conduit entrances shall be a conduit hub or the equivalent, such as a knockout or fitting, located so that when conduit is connected and the enclosure is mounted in the intended manner, the enclosure is found to be acceptable when subjected to the tests specified in Table 50.1 in the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E/CSA C22.2-94.2/NMX-J-235/2-ANCE.

6.15.4 When a panel mounted device is tested, it shall be mounted on a panel of the appropriate enclosure type, in accordance with the manufacturer's instructions.

Table 6
Enclosure types and tests

Designation	Intended use and description	Requirement for qualification tests[a]
1	Indoor use primarily to provide a degree of protection against a limited amount of falling dirt	Corrosion protection or rust resistance.
3R	Outdoor use primarily to provide a degree of protection against rain, sleet, and damage from external ice formation	Rain Test, Icing Test, Outdoor Enclosures, Indoor Enclosures, Corrosion Resistant Enclosures, Gaskets, Gasket Tests.
4	Indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water and damage from external ice formation	Hosedown test described in the Hose and Hosedown Tests, Outdoor Enclosures, Indoor Enclosures, Corrosion Resistant Enclosures, Icing Test, Gaskets, Gasket Tests.

Table 6 Continued on Next Page

Table 6 Continued

Designation	Intended use and description	Requirement for qualification tests[a]
4X	Indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose-directed water and damage from external ice formation.	Hosedown test described in the Hose and Hosedown Tests, Outdoor Enclosures, Indoor Enclosures, Corrosion Resistant Enclosures, Corrosion Resistance Test, Icing Test, Gaskets, Gasket Test.
6	Indoor or outdoor use primarily to provide a degree of protection against hose-directed water, and the entry of water during occasional temporary submersion at a limited depth and damage from external ice formation.	Hosedown test described in the Hose and Hosedown Tests, Icing Tests, Submersion Tests, Outdoor Enclosures, Indoor Enclosures, Corrosion Resistant Enclosures, Gaskets, Gasket Tests.
13	Indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive liquids.	Corrosion protection (5.3) or Rust Resistance Test, Oil Test, Gaskets, Gasket Test.

[a]For description of tests, see the Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E/CSA C22.2-94.2/NMX-J-235/2-ANCE.

7 Markings

Advisory Note: *In Canada, there are two official languages, English and French. Annex A provides translations in French of the English markings specified in this standard. Markings required by this standard shall be in English and may have to be additionally provided in other languages to conform with the language requirements of the country where the product is to be used.*

7.1 Details

7.1.1 A device shall be legibly and permanently marked with:

a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the device may be identified. The manufacturer's identification may be in a traceable code if the device is identified by the brand or trademark owned by a private labeler.

b) The configuration in accordance with Annex B, the catalog number or an equivalent designation, where practicable.

Exception: If the product is too small, or where the legibility would be difficult to attain to include the complete catalog designation or an equivalent designation, or where several catalog numbers use common parts, the complete designation shall appear on the unit container.

c) Devices shall be marked with their maximum rating in amperes and in volts. If the contact configuration of the device is one of the configurations illustrated in this Standard, the device ratings shall not exceed the maximum rating shown in the figure. Additional lower ratings may be marked at the manufacturer's option.

d) The current interruption - All devices shall be marked ″CAUTION - Risk of Electric Shock Do Not Disconnect Under Load″, or an equivalent statement following the word ″CAUTION″. This marking shall be visible while the device is in the mated condition.

e) The environmental rating – Device configurations Series 15, 16, and 18 as shown in Annex B shall be marked minimum rating of “Type 3R” as specified in Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E/CSA C22.2-94.2/NMX-J-235/2-ANCE. The marking shall be visible after installation and shall be permanent.

f) The environmental rating – All other devices shall be marked, “Type” followed by designation as specified in Standard for Enclosures for Electrical Equipment, Environmental Considerations, UL 50E/CSA C22.2-94.2/NMX-J-235/2-ANCE. The marking shall be visible after installation and shall be permanent.

7.1.2 Attachment plugs and connectors shall be marked for engagement alignment during mating and unmating conditions. Each device shall be marked with an indication of the action either by symbols or equivalent wording describing this function. The marking shall be visible while the device is in use.

7.2 Multiple factories

7.2.1 If a manufacturer produces or assembles devices at more than one factory, each finished device shall have a distinctive marking on the device, that may be in code, by which the device can be identified as the product of a particular factory.

7.3 AC only devices

7.3.1 A device that is intended for use on alternating current circuits only shall be identified as such by means of the letters ″AC″ or ″AC Only″, or an acceptable frequency marking (for example, ″60 Hertz″), or a phase marking, ″Ø″ which shall be a part of the electrical rating.

7.4 Identification of grounded and grounding devices

7.4.1 Devices designated for connection to the identified grounded (white/neutral) circuit conductor shall be identified by a white-colored housing. Devices designated for connection to the identified grounding (green/grounding) circuit conductor shall be identified by a green- or green/yellow-colored housing. All other device housings shall be colored other than green or white and readily distinguishable from each other.

7.4.2 Panel assembly devices designated for connection to the identified grounded (white/neutral) circuit conductor shall be identified by either white-colored housings or by housing surfaces colored white adjacent to both the grounded terminal and the grounded contact. Panel assembly devices designated for connection to the identified grounding (green/grounding) circuit conductor shall be identified by either green-colored housings or by housing surfaces colored green adjacent to both the grounding terminal and the grounding contact. Line devices intended for panel assembly shall be identified by housings or housing surfaces colored other than green or white and readily distinguishable from each other.